

CLAIMS

1. A resist protective film forming material for a liquid immersion lithography process for forming the resist
5 protective film suitably used for the liquid immersion lithography process, in which a light beam is selectively irradiated on the resist film through a non-aqueous solution, comprising:

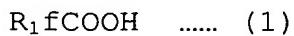
at least one component selected from water-soluble and
10 alkali-soluble film forming components.

2. The resist protective film forming material for a liquid immersion lithography process according to claim 1, wherein the liquid immersion lithography process improves
15 the resolution of resist patterns by irradiating a light beam on a resist film interposing a given thickness of the non-aqueous solution with a refractive index higher than that of the air at least on the resist film in a path, along where the lithography exposing light beam passes to
20 the resist film.

3. The resist protective film forming material for a liquid immersion lithography process according to claim 1, further comprising at least one component selected from an
25 acid generating reagent and acidic compound.

4. The resist protective film forming material for a liquid immersion lithography process according to claim 3, wherein the acidic compound is at least one compound
30 selected from a carboxylic acid, sulfonic acid and sulfonyl compound containing at least a fluorinated hydrocarbon group.

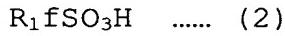
5. The resist protective film forming material for a liquid immersion lithography process according to claim 4, wherein the acidic compound is at least one compound selected from a compound represented by the following
5 general formula (1):



(in the general formula (1), R_1f is a fluorinated hydrocarbon group, where a part of or all of the hydrogen atoms of a saturated or unsaturated hydrocarbon group

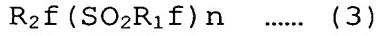
10 containing 1 to 20 carbon atoms are substituted with fluorine atoms),

a compound represented by the following general formula (2):



15 (in the general formula (2), the definition of R_1f is same as described above), and

a compound represented by the following general formula (3):



20 (in the general formula (3), the definition of R_1f is same as above, R_2f is a fluorinated hydrocarbon group or a fluorinated amino group, where the hydrogen atoms of a saturated or unsaturated hydrocarbon group containing 1 to 20 carbon atoms are substituted with fluorine atoms or a
25 hydrocarbon group or an amino group with no substitution, and n is an integer from 1 to 4).

6. The resist protective film forming material for a liquid immersion lithography process according to claim 1,
30 further comprising a nitrogen containing compound.

7. The resist protective film forming material for a liquid immersion lithography process according to claim 6,

wherein the nitrogen containing compound is at least one compound selected from quaternary ammonium hydroxide and alkanolamine compounds.

- 5 8. The resist protective film forming material for a liquid immersion lithography process according to claim 6, wherein the nitrogen containing compound is at least one compound selected from amino acid derivatives.
- 10 9. The resist protective film forming material for a liquid immersion lithography process according to claim 1, wherein the non-aqueous solution is a fluorinated liquid.
- 15 10. The resist protective film forming material for a liquid immersion lithography process according to claim 1, wherein the resist film, on which a protective film is formed, is formed by using a resist composition including:
 - 20 (A) a polymer composed of an alkali-soluble constitutional unit (a1) containing an aliphatic cyclic group having both of (i) a fluorine atom or fluorinated alkyl group and (ii) alcoholic hydroxyl group, and an alkali-solubility of the polymer changes when an acid acts on it; and
 - 25 (B) a resist composition containing an acid generating reagent when a light beam is irradiated.
- 30 11. The resist protective film forming material for a liquid immersion lithography process according to claim 1, wherein a pH value of the resist protective film forming material for a liquid immersion lithography process lies within the range from 2.4 to 2.8.

12. The resist protective film for a liquid immersion lithography process suitably used in the liquid immersion lithography process, in which a light beam is selectively irradiated on the resist film through the non-aqueous solution, the resist protective film is formed on the resist film using the resist protective film forming material according to claim 1.
13. A method of forming resist patterns using a liquid immersion lithography process comprising the steps of:
- 5 forming a resist film on a substrate;
 - forming a protective film composed of the resist protective film forming material according to claim 1 on the resist film;
 - 15 laying a given thickness of non-aqueous solution for liquid immersion lithography directly on at least the protective film of the substrate, on which the resist film and the resist protective film are formed;
 - selectively irradiating a light beam on the resist film through the non-aqueous solution for liquid immersion lithography and the protective film, and subjecting a heat treatment if necessary; and
 - 20 developing the resist film after irradiation and simultaneously removing the protective film to obtain resist patterns.
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